Disease Transmission and Rodent Pests

Role of insect in the spread and development of plant disease

Insect cause in the spread and development of plant disease in the following 6 ways-

1) Direct production of disease without the help of pathogen.
2) Dissemination of the pathogen.
3) Inoculation of the suscept with the pathogen.
4) Ingression of the pathogen into the suscept.
5) Invasion of the suscept by the pathogen.
6) Preservation of the pathogen.

1) Direct production of disease without the help of pathogen: Toxicogenic insect and toxicosis. For example, Potato leaf hopper (*Empoasca fabae*) causing *"Hopper burn"* of potato. After inject phytotoxic substances, potato leaves become burn. Squash bug causing *"Anasa wilt"* of cucurbits.

2) Dissemination of pathogen: Transfer of pathogen from disease suscept to another suscept/place is called dissemination. We know that pathogen can not cause disease in all stages of it's life cycle. For example; A fungus can cause disease only in its spore forming stage which is called inoculating stage. If that inoculum is not sprayed widely, diseased production will be less or totally not. That inoculum has not any organ by which they can disseminate. For their dissemination, they depends on the some agents such as wind, water, insect, man and other animals. Though wind is the most important and more agency for spore dissemination but there are some pathogen which can't be disseminated by wind rather they are entirely depend on insect for their dissemination. For example, *'Gummosis'* of sugarcane (bacterial disease) caused by flies. The disease first occur in leaves and sticky substances are produced. Their which contains bacterial cells, this sticky substances is attractive to the flies. They eat when sticky substances secret from the leaf but they can't digest it. As a result, they exerts it to another healthy leaf. Another example of such dissemination is *'Tungro disease'* of rice and green leaf hopper *(Nephotettix virescens)* is the only insect which can disseminate tungro virus. Therefore, we can say that insects can help in the spread of plant diseases which can't be transferred by other agent.

3) Inoculation of the suscept with pathogen: Inoculation means the transportation of pathogen to a particular part of the plant where infection may result. For disease development, Inoculation must be occurred in a particular part. For example, *'Powdery mildew'* is occurred only in the leaves not other parts of the plant.

Diseased cucurbit → Spore of the pathogen → Leaf of other cucurbit → Disease occur.

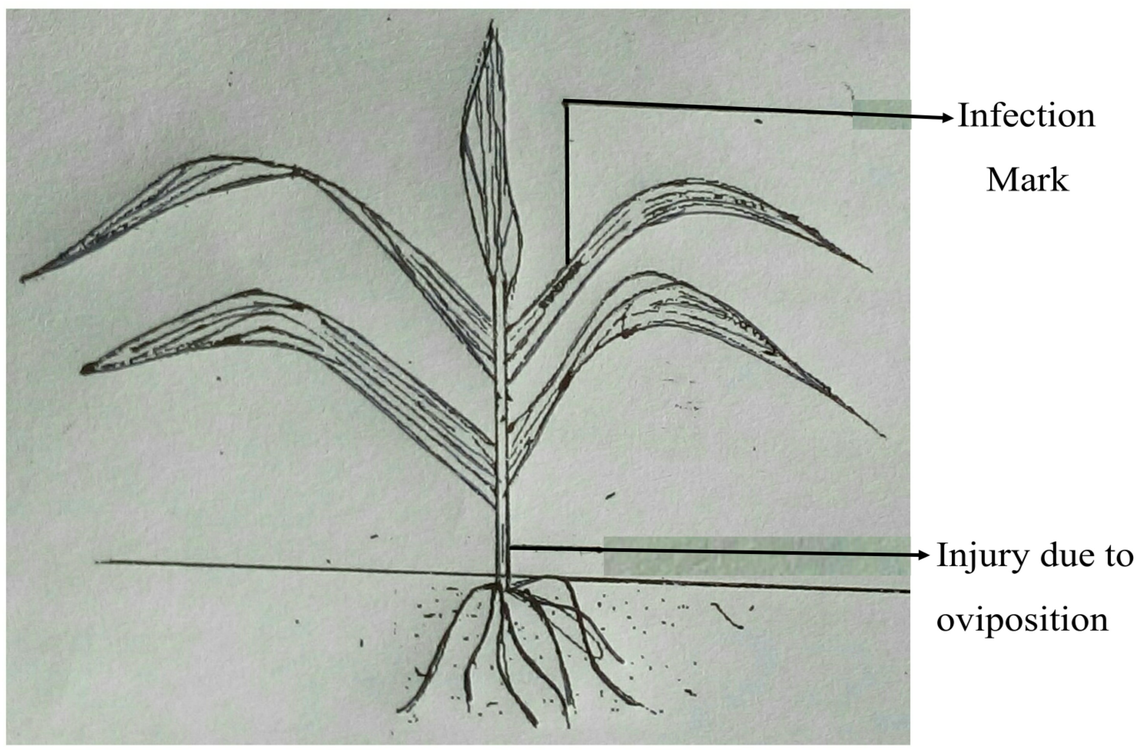
Diseased cucurbit → Spore of the pathogen → Soil → Disease not occur.

Diseased cucurbit → Spore of the pathogen → Root → Disease not occur.

Diseased cucurbit → Spore of the pathogen → Fruit/ Flower → Disease not occur.

However, insects play significant role in inoculation. For example, *'Blossom blight'* of fruits and honey bees. It is a bacterial disease which effects floral parts. Honey bee during collection of nectars from infected flower also collected inoculum and then transfer to other healthy flower. Thus it help in inoculation of "*blossom blight"*. Another example of insect inoculation is, *'Sigmatomycosis'* of cotton and Red cotton bug. This disease is also known as "internal boll rot".

4) Ingression of the pathogen into the suscept: Ingression is the process of growing entrance of the pathogen into the suscept. Most of the pathogen fail to entrance into the suscept through plant cuticle as it is composed of cutin, lignin, Cellulose, hemicellulose, waxy materials etc. That is why pathogen try to enter into the host through wounds or other natural openings. Insects favour this entrance by causing wounds. For example, Green Leaf Hopper and Fungal and bacterial infection occur. In this case, feeding and ovipositional mark predispose in rice plants and fungal and bacterial infection may occur. Other example, White grub and crown gall disease. White grub are soil inhibiting insect, they feed on root by cutting it. When root are cut and open, they are exposed to crown gall pathogen.



5) Invasion of the suscept by the pathogen: Invasion means spreading of the pathogen into the inner tissues of the suscept. Insects help in invasion of the suscept. For example, Brinjal Fruit and shoot borer and sooty mould fungus. These insect makes tunnel into the fruits. Another example, Wood boring beetle and wood rotting fungus. Two species of wood boring beetle (*Monochamus scutellatus*, *Monochamus notatus*) eat up the pith portion of the log of the trees. The wood boring fungus invade there by the way made by the beetle and damage the wood.

6) Preservation of the pathogen: All living organism want to survive. Pathogen is not an exception. During adverse weather, the winter insect survive by diapause and also help all the pathogen to survive or preserve. For example, cucumber beetle and bacterial wilt of Cucurbits. Cucumber beetle is the pest of cucurbits and winter is its adverse weather. Winter is also adverse to wilt bacteria when beetles feed on cucurbits. The bacteria into the digestive system of beetle and remain their inactive in winter. Next when summer come, the bacteria become active with the beetle and come through out anus of the beetle and infect cucurbits again. e.g. Corn flea beetles and bacterial wilts of corn.

Gall or Cecidium

Definition

A gall or cecidium is usually defined as an abnormal plant over growth caused by the parasitic plant or animal.

Types

▲ Phytocecidium: Caused by parasitic plant.

▲ Zoocecidium: Caused by animal.

Gall forming mites and insect

Mites

Acarus, Eriophyes, Phyllocoptes.

Insect

▲ Hymenoptera: Cynipidae (Gall wasps).

▲ Diptera: Agromyzidae (greenflies, blackflies or whiteflies), Tephritoidea (gall flies), Cecidomyiidae (gall midges), Chloropidae (grass flies).

▲ Homoptera: Aphididae (Chinese sumac aphid), Coccoidea (Scale insect), Psyllidae (Jumping plant lice).

▲ Besides, a few member of the Coleoptera and Lepidoptera can also produce gall.

How insect produce gall

Gall insect → Immature stage → Stimulating substance → Stimulated host tissue → Over growth → Gall.

Example: Rice gall midge and Onion shoot of rice.

Examples of Toxicogenic insect and their Disease (Toxicoses)

Sl no	Common name	Scientific name	Name of disease
1	Potato leafhopper	*Empoasca fabae*	Hopper burn of potato.
2	Cercopid	*Tomaspis inclusa*	Frog hopper blight of sugarcane.
3	Pineapple mealy bug	*Dysmicoccus brevipes.*	Mealy bug wilt of pineapple, Green spotting of pineapple.
4	Psyllid bug	*Bactericera (=Paratrioza) cockerelli*	Psyllid yellows of potatoes.
5	Squash bug	*Anasa tristis*	Anasa wilt of cucurbits

Example of Bacterial disease and their Vectors

Sl no	Name of Disease	Common name (Vector)	Scientific name (Vector)
1	Bacterial wilt of cucurbits	Cucumber beetle	*Diabrotica vittata* *D. undecimpunctata*
2	Bacterial wilt of corn	Corn flea beetle	*Chaetocnema pulicaria*
3	Bacterial wilt of solanaceae	Potato beetle	*Leptinotarsa decemlineata*
4	Black rot of crucifers	Cabbage worm	*Pieris brassicae*
5	Bean bacteriosis	Thrips	*Heliothrips fomoralis*
6	Potato black leg	Seed corn maggot	*Delia platura*
7	Soft rot of crucifers	Cabbage maggot	*Delia radicum*

Example of Fungal disease and their Vectors

Sl no	Name of Disease	Common name (Vector)	Scientific name (Vector)
1	Wilt of cotton	Grasshoppers	*Melanoplus differentialis*
2	Red rot of sugarcane	Sugarcane stem borer, Weevil	*Diatraea saccharalis*
3	Black leg of cabbage	Cabbage maggot	*Hylemya brassicae*
4	Potato scab	Flea beetle	*Epitrix cucumeris*
5	Leaf spot of tomato	Flea beetle	*Epitrix cucumeris*
6	Sooty mould of orange	White fly	*Aleyrodes citri*
7	Ergot of cereals & grasses	Carabid beetle Flies	*Carabus spp.* *Sciara thomae*

Example of Viral disease and their Vectors

Sl no	Name of Disease	Common name (Vector)	Scientific name (Vector)
1	Tungro disease of rice	Green leafhoppers	*Nephotettix virescens*
2	Dwarf disease of rice	Green leafhoppers	*Nephotettix nigropictus*
3	Cucumber mosaic	Aphid	*Aphis gossypii*
4	Tobacco mosaic	Aphid	*Myzus persicae*
5	Pumpkin mosaic	Cucumber beetles	*Diabrotica vittata*
6	Spotted wilt of tomato	Thrips	*Thrips tabaci*
7	Spindle tuber of potato	Grasshoppers	*Melanoplus spp.*

Major Rodent Pests of Bangladesh

Sl no	Common name	Scientific name	Damage
1	Black field rat/ Lesser bandicot.	*Bandicota bengalensis*	All field crops including rice.
2	Big black field rat/ Dhani Idoor/ Greater bandicot.	*Bandicota indica*	Crops in low land including rice.
3	House rat/ Black rat/ Gacho Idoor.	*Rattus rattus*	Stores, Fruit.
4	Brown rat/ Norway rat.	*Rattus norvegicus*	Stores.
5	Soft furred rat.	*Rattus meltada*	Wheat, Rice.
6	Pacific rat.	*Rattus exulans*	Stores, Fruit.
7	Mice/ Soloi Idoor.	*Mus musculus*	Stores.
8	Short tailed mole rat.	*Nesokia indica*	Sugarcane.
9	Brown squirrel/ Kat birali.	*Callosciurus pygerythrus*	Fruit.
10	Striped squirrel/ Kat birali.	*Funambulus pennantii*	Fruits, stores, field crops.
11	Porcupine/ Soojaroo.	*Hystrix hodgsoni*	Plantation crops, Winter vegetables.

Control of Rodent Pests

A. Non-chemical control

1. Inspect field, houses and godown often regularly.

2. Hygiene

I) Houses and buildings

- ♦ Keep stores and good tidy.
- ♦ Sweep stores and houses everyday.

II) Fields

- ♦ Cut and burn unnecessary vegetation.
- ♦ Keep fences clean (particularly near houses).
- ♦ Burn crop residues and rubbish piles.
- ♦ Keep dikes small between paddy fields.
- ♦ If possible, flood fields.

3. Proofing

I) Buildings

♦ Materials used for proofing the buildings and containers should be hard enough to resist the gnawing the rat that is cement, metal, bricks.

♦ Cracks and holes in walls should be closed and doors should provide a tight fit.

♦ Doors should be closed tightly particularly godowns when it is not used.

♦ All wooden frames, doors and windows to which rat have access, should be protected by metal strips to prevent rats cutting hole.

♦ In village hunts which can not be made rat proof, all food should be kept in rat proof containers.

II) Trees

Metal sheet (about 50 cm wide) tightly fit around the trunks of trees at least 2 meter height to stop rats and squirrel climbing up.

4. Trapping

♦ Kill or snaps trap: Kill the animal upon being trap.

♦ Life trap: Traps in which the animal caught in alive.

5. Smoking and watering

Rats can be driven out by pouring water or smoke into the burrows. If available, a net should be placed on top of the burrow system to prevent rat escaping.

6. Digging

By digging the burrow system, rats can be killed.

B. Chemical

1. Poison bait

a) Single dose poison (acute poison): These poison act rapidly and killed rats after a single feed. e.g. Zinc phosphide.

b) Multiple dose poison (chronic poison): These poison act slowly and an animal dies generally a few days after taking of poisons. e.g. Anticoagulant.

2. Tracking powders

Some Anticoagulant rodenticide are offered as tracking powder. These powder are sprayed on the ground along runways or near holes.

3. Gassing

To gas burrows a teaspoonful of poison powder (NaCN, HCN) or 1-2 tablets (phostoxin) are placed inside an open hole then all holes are tightly closed with earth.

4. Fumigation

Methyl bromide and phostoxin are very effective in killing a resident rat population in stores or ships.

Population Dynamic

Factors responsible for regulating the population size of rodents pest are:

1. Competition.
2. Predation.
3. Parasitism.
4. Weather.
5. Habitat- Food and shelter.
6. Reproductive potential.

1. Competition

Inter-specific competition: Competition among species. e.g. competition between Black field rat and mice.

Intra-specific competition: Competition among individuals of a species. e.g. Healthy and strong mice vs weak mice.

2. Predation

Cats, dogs, snakes, lizards, owls, Hawks etc.

3. Parasitism

Myxomatosis (virus disease) of rabbit.

4. Weather

Adverse weather condition. e.g. Black field rat → Rainy season.

5. Habitat

Plenty food and good shelter. Black field rat → Green vegetation, Moist soil.

6. Reproductive potential

Prolific breeders: Many young/litter → Many young/season. Black field rat can from 2-3 months ago 16 young/litter. A single female can produce about 300 young/year.

Sign to organize the presence of rodent pest

1. Burrow.
2. Foot print.
3. Dropping.
4. smear.
5. Run way.
6. Nest.
7. Sound.
8. Damaged object.

Toxicogenic insect

Toxicogenic insect are those insect which can produce disease in plants without the help of pathogen. For example, GLH, Cotton leaf hopper, Squash bug.

Toxicoses

The plant disease which are produced by Toxicogenic insect are commonly refers at Toxicoses.

How is Toxicoses produced in plant

Toxicoses are produced in the plant due to Toxicogenic insect. Toxicogenic insect have capacity to produce phytotoxic substances. During feeding they invade these phytotoxic substances into the host cell and produce disease called Toxicoses.

Some Gall producing Insects and Mites

A. Insect

Common name	Scientific name	Gall producing site
Rice gall midge	*Orseolia oryzae*	Stem
Mango leaf gall midge	*Procontarinia matteiana*	Leaf
Mango twig gall midge	*Rhabdophaga mangifera*	Twig
Mango bud gall psyllid	*Apsylla cistellata*	bud
Golden rod Gall Midge	*Eurosta* spp.	Stem
Wooly Oak gall wasps	*Callirhytis lanata*	Leaf
Mossy Rose Gall Wasp	*Diplolepis rosae*	Leaf
Eastern spruce gall adelgid	*Adelges abietis*	Twig

B. Mites

1. Litchi mite ..... *Aceria litchii* ..... Leaf.

2. Pear blister mite ..... *Eriophyes pyri* ..... Leaf.